Olsson Associates
Consulting Engineers
1111 Lincoln Mall
Lincoln, Nebraska
September 21, 2007

ADDENDUM NO. 2
Waterford Estates 24-Inch Trunk Sewer
E.O. No. 79443
T.C. No. 801645
Lincoln, Nebraska - 2007
Spec. No. 07-294

TO ALL WHO HAVE RECEIVED PLANS AND SPECIFICATIONS FOR THE REFERENCED PROJECT.

SCOPE

This Addendum covers the following additions, modifications, and clarifications to the Drawings and Specifications for this project.

GENERAL

1. Prebid Meeting. A Prebid Meeting was held on September 19, 2007. The attendance list, the minutes for the meeting, and a hard copy of the Power Point presentation are attached to this Addendum. The minutes of the Prebid Meeting and a copy of the presentation are provided for general information only and are not intended to be used as part of the bidding or contract documents for the project. Bidders are to refer to the Project Specifications and Drawings for information.

SPECIAL PROVISIONS

1. Refer to the ARTICLE II. PROPOSAL REQUIREMENTS AND CONDITIONS in the SPECIAL PROVISIONS TO THE GENERAL CONDITIONS & REQUIREMENTS.

   a. Refer to Item B. TYING BIDS. The Bid Opening will be postponed from 9/26/07 to 10/10/07.

2. Refer to ARTICLE VIII. GUARANTEE & PAYMENT in the SPECIAL PROVISIONS TO THE GENERAL CONDITIONS & REQUIREMENTS.

   a. Refer to Item B. SUBSTANTIAL COMPLETION. Delete the following:

      "The project shall be substantially complete within 150 days from the project commencement date."

      Add the following:

      "The project shall be substantially complete by July 1, 2008."

   b. Refer to Item C. ACCEPTANCE OF WORK. Change the final completion date from May 15, 2008, to September 1, 2008.

3. Refer to the MATERIAL AND CONSTRUCTION SPECIFICATIONS in the SPECIAL PROVISIONS TO THE GENERAL CONDITIONS & REQUIREMENTS.

   a. Add the attached Specification Section titled, "SECTION 02330 TUNNEL GROUT" to Division 2 - Sitework.

Each Bidder must acknowledge receipt of all addenda in the space provided on the Proposal form.

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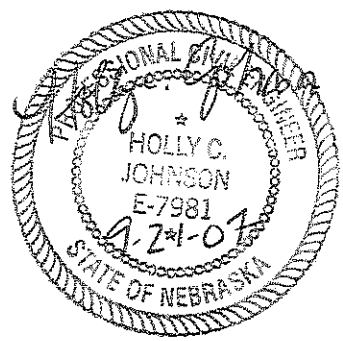

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MEETING MINUTES

PRE-BID MEETING

	Overnight
X	Regular Mail
	Hand Delivery
X	Other: Addendum

NAME OF PROJECT:	WATERFORD ESTATES 30-INCH TRUNK SEWER (E.O. 78974) WATERFORD ESTATES 24-INCH TRUNK SEWER (E.O. 79433)
PROJECT LOCATION:	Lincoln, Nebraska
MEETING LOCATION:	Theresa St. Wastewater Treatment Plant, Training Room
DATE & TIME:	Wednesday, September 19, 2007 – 1:00 p.m.
PROJECT #:	2005-0079
PHASE/TASK #:	700, 700004

ATTENDEES:

NAME	ORGANIZATION	PHONE #	FAX #	EMAIL
Derek Bookstrom	H.R. Bookstrom	464-4342	464-4846	dsb-bookie@yahoo.com
Joe McLaughlin	H.D.S.	430-9920	438-1229	Joe.Mclaughlin@HDSupply
Ray Lipsey	Lipsey Construction	432-2293	420-6675	
David Rathjen	City – Engr. Services	441-7594		
Mike Mandery	LWWS	441-7988		mmandery@lincoln.ne.gov
Don Day	Olsson Associates	458-5644		dday@oaconsulting.com
Brian Egr	General Excavating	467-1627	467-2084	begr@generalexcavating.com

The meeting commenced at 1:00 p.m. with a power point presentation by Holly Johnson, Olsson Associates, offering a general overview of the project. Ryan Beckman, Olsson Associates, presented information from the Geotechnical Report. A list of attendees and a copy of the powerpoint slides are attached. Some of the major points discussed include:

- The Owner of the projects is Waterford, LLC. The City will assume ownership of the project upon completion of construction and will reimburse the Owner for construction and engineering costs in the future.

- Brian Kramer, Lincoln Wastewater System (LWWS), explained that the Contractors should view this project as a Capital Improvements Project (CIP), not as a standard Executive Order project such as an 8-inch trunk sewer in a Subdivision. These projects will have a full-time resident observer which will most likely be Olsson Associates. Monthly progress meetings will be held with Lincoln Wastewater in attendance. While Waterford LLC is the temporary Owner of the project, the City will be very involved in the construction since they will assume ownership upon completion of the project. The plans and specifications have been prepared as per LWWS standards which differ from the City of Lincoln Standard plans and specifications.

- The 30" trunk sewer project includes 30", 24", 15" and 8" diameter piping. All piping is installed by open trenching. The 24" sewer project includes 24" and 8" piping. The majority of the project is open trenched. There are two tunnels in the project and 275 feet of pipe installed in an existing steel casing under No. 98th Street. Manholes will be 5-foot and 6-foot diameter with a T-lock liner. There will also be one creek crossing in the 24" trunk sewer project.

- Ryan Beckman talked about the geotechnical conditions. Groundwater is expected when installing all of the 30" trunk sewer and at least 800 feet of the 24" project up to the tunnels under the Spillway. At the tunnels, soil conditions transition to Dakota Sandstone which is a very dense sugar sand. One boring showed a little ironstone. Dick Shanahan has experience with excavating the area since they have been working on the site grading. Blow counts are often over 100. Dispersive soils are also expected up to the tunnels under the Spillway. Therefore, the pipe bedding material is specified to be wrapped in Geotextile fabric until the trench is in sandstone. There were no questions raised by the meeting attendees on soil conditions.

- There are two construction entrances into the project shown on the plan sets. One is on Holdrege Street and the other is on "O" Street. Refer to the project drawings for the limits of construction. Wetlands are shown on the drawings with procedures for reseeding. The SWPPP is also included on the drawings sets.

- The 24" trunk sewer project will have two tunnels. The Contractor is allowed to install the pipe by microtunneling or two-pass tunneling.

- The Contractor is allowed to use vitrified clay, solid wall PVC, Lamson Vylon profile wall PVC, or Hobas pipe on this project. More than one type of pipe can be used. However, only one type of pipe can be installed between manholes.

- Manholes shall be provided as per the Lincoln Standard Plans with a T-lock Liner.

- The Owner is in the process of obtaining an amendment to the 404 permit for the site for the creek crossing, the floodplain development permit and the NPDES permit for stormwater discharge. The Contractor will be required to co-sign the NPDES permit. The final plans and specifications have also been sent to the NDEQ for amendment of the construction permit.

- The Bid Form is unit price. The contracts for the 24" and 30" are tied so Contractors must bid on both projects. A questionnaire and bidder's qualifications must also be submitted with the Bid Proposals for review. Liquidated damages are $1,000 per day for both substantial completion and final completion. Five percent retainage will be held out of progress payments until substantial completion. The Contractor must warranty both projects for two years.

- The Contract Documents include the Lincoln Standard Plans and Specifications and the Special Provisions and drawings prepared by Olsson Associates.

- There are several dates which the Contractors should be aware of. Addendum No. 1 has been given to the City to add a microtunneling specification to the 24" project. The tunnel grout specification will also be added by a future addendum. The last day for questions is September 21st. A final addendum will be issued by September 24th at the latest. Bids will be opened on September 26th. The Contractor will have 90 days to Substantial Completion for the 30" project and 150 days to Substantial Completion for the 24" project. The final completion date for both projects is May 15, 2008.

- The Contractor is required to verify the location of all utilities before starting work. Most of the utilities are being installed at this time and are shown on the project drawings. Construction staking will be performed by Olsson Associates.

- The Contractor should read the tunneling specifications thoroughly. A tunneling work plan is required with submittals described in several sections of the specifications.

- A groundwater and surface water monitoring plan will also be required for the 24" trunk sewer. This plan is described in Section 02801.

- All questions must be directed to Vince Mejer, Lincoln Purchasing, in writing. His email is Vmejer@lincoln.ne.gov. Questions will be forwarded to the appropriate party for a response.

QUESTIONS & ANSWERS

Questions that were raised during the meeting are summarized below, along with answers. A meeting was held with the Developer on September 20, 2007. Additional information is provided below from that discussed during the meeting.

Q1: Will the completion time be extended?

A1: The contract time was set by the Developer. The Engineer explained that the date was set when housing would be complete. A meeting was held with Waterford LLC on September 20, 2007, to discuss a time extension. An addendum will be issued to postpone the bid date two weeks and to extend the construction time frame.

Q2. Concrete Industries will not be able to construct the manholes with the T-lock lining until December. Can this liner be omitted so that the project can be completed on time? TJ Osborn is installing fiberglass manholes on his project.

A2. T-lock lining is a LWWS standard. The City has not used fiberglass manholes in the past. The Osborn project is the first one with this type of manhole. The T-lock lining cannot be omitted. The Owner will contact Concrete Industries and find out if the manhole construction can be expedited.

Please contact Holly Johnson at 402-458-5669 if there are additions or corrections to these meeting minutes.

Submitted by: Holly C. Johnson HCJ/ma

Enclosures: Meeting Attendees
Powerpoint Presentation

Distribution: Attendees
Brian Kramer, LWWS
Mark Palmer, Olsson
John Brager, Waterford LLC

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ATTENDANCE LIST
PRE-BID CONFERENCE
WATERFORD ESTATES 30-INCH TRUNK SEWER (EO 78974)
WATERFORD ESTATES 24-INCH TRUNK SEWER (EO 79433)
LINCOLN, NEBRASKA
OA PROJECT NO. 2005-0079
WEDNESDAY, SEPTEMBER 19, 2007 – 1:00 PM

Name of Attendee (Please Print)	Company/Department Representing	Email Address	Phone No.	Fax No.
DEREK	H.R. BOOKSTROM	dsb_bookic@yahoo.com	464-4342	464-4846
JOE McLaughlin	H.D.S.	JOE.McLaughlin @ HD Supply	430-9920	438-1229
Ray Lipsey	Lipsey		432-2293	420 6675
David Rathjen	City Engr Services		441-7594	
mike mandery	LWWS	mmandery@lincoln.ne.gov	441-7968	
DON DAY	OA	dday@oaconsulting.com	458-5644	
BRANDER	GE	[illegible]	467-1627	467-2024

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Welcome!

WATERFORD 30-INCH AND 24-INCH
TRUNK SEWERS
Pre-Bid Meeting
September 19, 2007, 1:00 p.m.

OLSSON ASSOCIATES

Workshop Agenda

- Introduction of Project Team
- Project Overview
- Geotechnical Conditions
- Site Access & Limits of Construction

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Workshop Agenda

- Construction Techniques
- Materials
- Permits Obtained by Owner

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Workshop Agenda

- Bid Form/Payment
- Contract Documents
- Milestone Dates
- Contractor Investigation & Documentation
- Other Questions?

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Introduction of Project Team

- Owner
  - Waterford Estates LLC
- City of Lincoln, Nebraska
  - Public Works & Utilities – David Rathjen
  - Lincoln Wastewater System – Brian Kramer
- Design Team
  - Olsson Associates

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Project Overview

- 30-inch diameter sewer project
  - 1,455 linear feet of 30"
  - 10 linear feet of 24"
  - 10 linear feet of 15"
  - 47 linear feet of 8"

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Project Overview, continued...

- 24" diameter sewer project
  - 5,458 linear feet of 24" (open cut)
  - 13 linear feet of 8" (open cut)
  - 275 linear feet of 24" (installed in existing casing)
  - 396 linear feet of 24" (two-pass tunneled or micro-tunneled)

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Project Overview, continued...

- Manholes
  - 30-inch trunk sewer project
    - 4 Each Type G manholes (6' diam.)
    - 2 Each Type H drop manholes (6' diam.)
  - 24-inch trunk sewer project
    - 14 Each Type P manholes (5' diam.)
    - 2 Each Type Q drop manholes (5' diam.)

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Project Overview

- Creek Crossing (24" Trunk Sewer Project)
  - Sheet piles
  - Sewer concrete encased
  - Grouted riprap

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Project Overview-Connections to New Sewers

- 30" Trunk Sewer
  - 30" Connects to 30" Pipe exiting a Temporary Lift Station to be constructed at Sta. 500+00
  - At Sta. 514+54.78, install 24" sewer and plug
- 24" Trunk Sewer
  - Sta. 0+10, Remove 24" plug and connect to 24" piping installed as part of 30" trunk sewer project
  - Sta. 61+74.35, Install 24" stub-out and plug for future

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Overview of Geotechnical Conditions

- Dewatering requirements
- Dakota sandstone
- Dispersive soils (Entire length of 30" project and first 800 feet of 24" project)

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Site Access

- Access points to the project site
  - Existing construction entrance on Holdrege St
  - Existing construction entrance on "O" Street

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Limits of Construction & Site Restrictions

- 30" Trunk Sewer (Sheet 4 – Horizontal and Vertical Control)
- 24" Trunk Sewer (Sheets 22 – 25)
- Wetlands, dewatering, & SW3P discharges

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Construction Techniques

- 30-Inch Trunk Sewer
  - Open cut
- 24-Inch Trunk Sewer
  - Open cut
  - Two tunnels under spillway
  - Installation in existing steel casing under 98th Street

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Construction Techniques

- Open-cut trenching
- Tunneling
  - Microtunneling (Hobas or VCP)
  - Two-pass tunnel using primary support of gasketed tunnel liner plate or steel casing (PVC, Hobas, or VCP)

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Materials

- Sewer pipe 24" & 30" diameters
  - Centrifugally cast fiberglass reinforced polymer mortar (CCFPM) pipe – HOBAS only
  - Polyvinyl chloride (PVC) – profile wall (Lamson Vylon only) and solid wall PVC
  - Vitrified clay pipe

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Materials

- Manholes
  - Pre-cast concrete with plastic lining
  - L.S.P. 201: Wastewater Manholes Type 'G', 'H', 'P' and 'Q'

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Permits obtained by Owner

- US Army COE 404 permit (Amendment to permit for the entire site)
- Floodplain development permit
- NPDES construction site stormwater discharge permit (co-sign with Owner)
- NDEQ construction permit

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Bid Form/Payment

- Unit price contract
- Contracts are tied for the 24" and 30" trunk sewer projects and both jobs will be awarded to one Contractor
- Questionnaire
- Bidder's qualifications

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Bid Form/Payment

- Liquidated damages
  - $1,000/day Substantial Completion
  - $1,000/day Final Completion
- Retainage
  - 5% until Substantial Completion
- 2-Year Project Warranty

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Contract Documents

- Special Provisions
- Plans
- City of Lincoln Standard Specifications for Municipal Construction and City of Lincoln Standard Plans

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Milestone Dates

- Addendum #1 for 24" Project (Section 02315 – Micro-tunneling added)
- Addendum #2 for 24" Project (Section 02330 – Tunnel Grout to be added)
- September 21, 2007 - Last day for questions
- September 24, 2007- Final Addendum Issued
- September 26, 2007 - Bids received and opened
- 90 days (30") and 150 days (24") to Substantial Completion
- Final Completion – May 15, 2008

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Contractor Investigation & Documentation

- Investigate/verify locations of all existing utilities prior to beginning work
- Construction staking shall be performed by the Engineer

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Contractor Investigation & Documentation

- 24" Trunk Sewer Project
  - Tunneling work plan (tunnel shafts, tunneling methods, grouting)
  - Monitoring plan for groundwater and surface water (Section 02801)

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Thank you-Questions?

- Self-guided tours of alignment
- Contact Vince Mejer, City of Lincoln Purchasing Dept. with questions regarding the plans and specifications (402-441-8314 or vmejer@lincoln.ne.gov)

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SECTION 02330

TUNNEL GROUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section specifies the mix design requirements, testing, furnishing and production of grout for:

1. Pressure grouting of primary tunnel liner.

2. Pressure grouting of bolted liner plates for shafts.

3. Backfill grouting of the annular space between the sanitary sewer pipe and the primary tunnel liner.

4. Ground stabilization grouting by filling of voids in soil outside tunnels and shafts.

1.2 DEFINITIONS

A. Pressure Grouting. The filling with mortar grout of the excavated space between primary tunnel or shaft liner and the surrounding ground.

B. Backgrouting. A secondary stage pressure grouting to ensure that all voids have been filled between tunnel and shaft liners and ground.

C. Annular Grouting. A low shrink grout mix of controlled density, pumped to fill the annular space between the carrier pipe and the primary tunnel support.

D. Ground Stabilization. The filling of voids or seepage channels occurring outside shaft or tunnels due to ground loss with grout and aggregate filler placed under gravity head or by pressure compatible with the affected installation. Compaction grouting is not part of this Specification.

1.3 REFERENCE STANDARDS

A. ASTM C138 Standard Test Method for Unit Weight, Yield and Air Content (gravimetric) of Concrete

B. ASTM C144 Standard Specification for Masonry Mortar

C. ASTM C150 Standard Specification for Portland Cement

D. ASTM C494 Standard Specification for Chemical Admixture for Concrete

E. ASTM C618 Standard Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete

F. ASTM C796 Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam

G. ASTM C869 Standard Specification for Foaming Agents and in Making Preformed Foam for Cellular Concrete

H. ASTM C937 Standard Specification for Grout Fluidifier for Preplaced Aggregate Concrete

I. ASTM C940 Standard Test Method for Expansion and Bleeding of Freshly Mixed Grout for Preplaced Aggregate Concrete

J. ASTM C942 Standard Test Method for Compressive Strength of Grout for Preplaced Aggregate Concrete into Laboratory

K. ASTM C953 Standard Test Method for Time of Setting of Grout for Preplaced Aggregate Concrete in the Laboratory

L. ASTM C1017 Standard Specification for Chemical Admixture for use in Producing Flowing Concrete

M. U.S. Army Corps of Engineers CRD C621 Specification for Non-shrink Grout

1.4 SUBMITTALS

A. At least 30 days prior to grouting, submit a work plan for grouting in accordance with the General Conditions and Requirements. The data shall include test results and a detailed description of materials, equipment and operational procedures to accomplish the grouting operation including:

1. Grout mix design report:

a. Grouting method and grout type.

b. Grout mix constituents and proportions including all materials by weight and volume.

c. Grout densities and viscosities, including wet density at point of placement.

d. Initial set time of grout.

e. Temperature rise.

f. Bleeding, shrinkage/expansion.

g. Compressive strength.

2. A detailed description and drawing indicating locations of surface mixing equipment, subsurface injection points, vent locations, flowlines, waste grout recovery, flow control and grout pressure limiting equipment.

3. A detailed description of the grouting sequence and time schedule, and grout stage volumes.

4. For annular space grouting, buoyant force calculations and bulkhead designs. (See Section 02725 - Sanitary Sewer Line in Tunnels for further requirements).

5. Certification of calibration for metering devices and pressure gauges.

6. Proposed quantity and quality assurance report records.

7. List and schedule for materials, services, laydown space, utilities, service connections or other provisions.

B. During grouting operations, maintain and submit daily logs of grouting operations including pressure, density, grout volume and grout mix pumped, and such other data as required by the Engineer.

C. The work plan for grouting shall be signed by a Professional Engineer registered in the State of Nebraska.

1.5 CRITERIA FOR GROUTING

A. The Contractor shall establish the criteria which the grouting operations will meet in conformance with the requirements of these Specifications.

B. The system shall have sufficient gages, monitoring devices and tests to determine the efficiency and effectiveness of the grouting work, and provide means of accurately determining the amount of grout injected. The Contractor shall be prepared to modify or change his materials and operation should the grouting not perform as proposed. Such modifications and changes shall be done in a timely manner to avoid unnecessary delay to completion of the Project.

C. Mix Designs. One or more mixes shall be developed based on the following criteria as defined by the Contractor:

1. Size of the annular void between sewer pipe and liner, or void size between primary liner and the surrounding soil.

2. Absence or presence of groundwater.

3. Sufficient strength and durability to support the liner or to prevent movement of the sewer pipe.

4. Adequate retardation.

5. Non-shrink characteristics

6. Density. For annular grouting, design a grout mix with a density to prevent floating of the sewer pipe.

D. No deleterious amounts of toxic or poisonous substances shall be included in the grout mix nor otherwise injected underground.

PART 2 PRODUCTS

2.1 MATERIALS

A. Grouting materials shall conform to Chapter 11 - Portland Cement Concrete, except as modified in the following paragraphs.

B. Grout Type Applications

1. Grout for pressure grouting and backgrouting shall be a sand-cement mortar mix.

2. Grout for annular grouting shall be a sand-cement mortar mix, unless otherwise approved by the Engineer.

3. Grout for ground stabilization shall be selected by Contractor depending on the application conditions.

2.2 GROUT

A. The Contractor shall employ and pay for a commercial testing laboratory, acceptable to the Engineer, to prepare and test the grout mix design.

B. The Contractor shall design one or more mixes to meet the design criteria and conditions of the tunnel. The proposed annular grout mixes must be designed and tested by a Professional Engineer experienced with grout. The information required by Paragraph 1.5 shall be presented in the mix design report including the following:

1. Cement: ASTM C150
   a. Source, brand, and type
   b. Volume and weight per cubic yard of slurry

2. Fly Ash: ASTM C618
   a. Source, brand, and type
   b. Volume and weight per cubic yard of slurry

3. Water: Potable
   a. Volume and weight per cubic yard of slurry
   b. Water - cement ratio

C. The grout shall meet the following minimum requirements:

1. Minimum 28 day unconfined compressive strength shall be 1,000 psi for mortar grout. Strength shall be determined by ASTM C942.

2. The flow of the grout as mixed shall be 10 to 25 seconds for mortar grout as measured by flow cone according to ASTM C939.

3. Non-shrink characteristics, and the water bleeding shall not exceed 2 percent according to ASTM C940.

4. The allowable wet density range of the grout mix at the placement location shall be defined by the Tunnel Work Plan.

   For sand-cement mortar grout mixes the sand shall conform to ASTM C144, except as modified below:

U.S. Standard Sieve Size	Percent Passing by Weight
No. 16	100
No. 30	60-85
No. 50	10-35
No. 100	5-25
No. 200	0-10

D. Fluidifier. A fluidifier meeting ASTM C937 shall be used that holds the solid constituents of the grout in colloidal suspension and is compatible with the cement and water used in the grouting operations. A shrinkage compensator shall be added.

E. Admixtures. Admixtures meeting ASTM C494 and ASTM C1017 may be used subject to the approval of the Engineer to improve pumpability, to control time of set, to hold sand in suspension and to reduce segregation and bleeding. For cellular concrete, the admixture brand, content, batching method, and time of introduction to the mix shall be in accordance with the foam concentrates manufacturer's recommendations, tested and submitted to the Engineer for approval. Contractor shall ensure that all admixtures used in a mix are compatible and shall, if required by the Engineer, provide written confirmation from the admixtures manufacturers of their compatibility.

F. Fly Ash. Fly ash, conforming to the requirements of ASTM C618, may be used in the mix.

PART 3 EXECUTION

3.1 PREPARATION

A. The grout mix design reports and other submittals required shall have been accepted by the Engineer prior to start of grouting operation. The Engineer shall be notified at least 24 hours in advance of annular grouting operations. Other grouting operations shall proceed as required in conjunction with related work.

B. Grouting equipment and procedures shall be selected and operated with sufficient safety and care to avoid damage to existing underground utilities and structures and at a pressure not great enough to distort or imperil any portion of the work, new or existing.

3.2 EQUIPMENT

A. Batch and mix grout in equipment of sufficient size and capacity to provide the necessary quality and quantity of grout for each placement stage. The Contractor shall be responsible for selection and operation of equipment for grout material handling, mixing, pumping and placement operations, meeting the following minimum requirements.

1. Pressure Grout. Equipment used for pressure grouting shall be of a type and size generally used in tunnel grouting work and be capable of mixing grout to a homogeneous consistency, and providing means of accurately measuring grout component quantities and accurately measuring pumping pressures. The grout shall be delivered to the injection point at a steady pressure.

B. Pressure Gages. Contractor shall provide one pressure gage at the point of injection and one pressure gage at the grout pump. Grouting shall not proceed without appropriate gages in place and in working order. Use ranges of pressure gages, as required, for each part of the grouting program.

C. Stop Valves. Contractor shall provide suitable stop valves at the collar of the hole for use in maintaining pressure, as required, until the grout has set.

3.3 PRESSURE GROUTING FOR PRIMARY TUNNEL LINING

A. Perform grouting operations to effectively and completely fill voids outside of the primary tunnel liner as quickly as possible in accordance with Section 02310 - Tunnel Excavation and Primary Liner.

3.4 PRESSURE GROUTING FOR SHAFTS

A. Perform grouting operations to effectively and completely fill voids outside shaft liner as quickly as possible in accordance with Section 02308 - Tunnel Shafts.

3.5 ANNULAR GROUTING

A. Place backfill grout in the annular space between the sanitary sewer pipe and the primary tunnel supports in accordance with Section 02310 - Tunnel Excavation and Primary Liner.

3.6 DEWATERING SYSTEM OPERATION

A. The dewatering system shall be operated until the pressure and annular backfill grouting of the sewer pipe are complete.

3.7 TESTING

A. Density of the grout shall be measured throughout the placement procedure as specified or directed by the Engineer.

B. Samples of well-mixed pressure and annular grout shall be taken for 28-day compressive strength tests at the beginning, middle and end of each grouting operation for each section of liner, pipe or annulus.

C. Grout density for pressure grouting shall be measured at the discharge point and grout shall be discharged until the density is within 0.3 pounds per gallon of the input density.

END OF SECTION